
The role of cellular interactions in the induction of hepatocyte polarity and functional maturation in stem cell-derived hepatic cells.

Journal: Differentiation

Publication Year: 2019

Authors: Brandon J Blau, Toshio Miki

PubMed link: 30878880

Funding Grants: Development of a clinical-grade extracorporeal liver support system using human induced pluripotent stem cell-derived hepatic cells

Public Summary:

The liver contains various types of cells. The cell-cell and cell-extracellular matrix interactions are important to maintain liver functions. Therefore the knowledge of these interactions is essential to develop a functional bioartificial liver support system, which can support liver disease patients. In this review, we explore the literature that has examined the potential mechanisms that maintain and induce liver functions and discuss the future implications of this knowledge in a clinical setting from a bioengineering perspective.

Scientific Abstract:

The unique microenvironment found within the liver in vivo plays a key role in the induction of functional maturation in the developing hepatocyte. During organogenesis, hepatocytes acquire a polar phenotype that allows them to perform their functions of bile production and transport, protein synthesis, metabolism, and detoxification simultaneously, independently, and efficiently. It is thought that the induction of polarity and functional maturation in hepatocytes is dependent on the complex interplay of cell-cell and cell-extracellular matrix (ECM) interactions. While this process is highly efficient in the human liver, it has been shown that hepatocytes rapidly lose their functions when placed in cell culture. This poses a challenge for the development of a bioartificial liver (BAL) support system, which utilizes a live cellular source to perform hepatic functions in the event of acute liver failure or primary nonfunction. However, once the molecular mechanisms underlying the induction of hepatocyte polarity are fully identified, it will be possible to develop highly functional hepatic cells from human pluripotent stem cells (hPSCs). This new cell line would be an ideal cellular source for a BAL system, as it would have both the functionality and longevity to support a patient through the entire clinical course of treatment. In this review, we explore the literature that has examined the potential mechanisms that induce polarity in the developing hepatocyte and discuss the future implications of this knowledge in a clinical setting from a bioengineering perspective.

Source URL: <https://www.cirm.ca.gov/about-cirm/publications/role-cellular-interactions-induction-hepatocyte-polarity-and-functional>